offer recreation opportunities similar to those available at Coeur d'Alene Lake (table 6). By far, the largest is Lake Pend Oreille, the southern end of which is within the 50 mile (80 kilometer) radius. The majority of these lakes are accessible by car; only a few of the lateral lakes adjacent to the Coeur d'Alene River are restricted to boat access only.

In 1991 the Idaho Department of Fish and Game conservatively estimated the gross economic value of the Coeur d'Alene Lake fishery at $6 million. The kokanee fishery contributed almost half, while chinook salmon and spiny rays (which included the "trophy" pike fishery) contributed approximately $225,000 and $330,000, respectively (Coeur d'Alene Tribe, written commun., 1994).

Coeur d'Alene Lake is a source of water for agricultural, domestic, and industrial use. At least six public water supply systems use the lake water, including, until recently, the city of Coeur d'Alene. The Idaho Department of Water Resources records 220 water rights filed to withdraw water from Coeur d'Alene Lake (Idaho Department of Water Resources, written commun., 1993). Although environmental and public health agencies advise against using surface water for domestic purposes without extensive treatment, many of these permitted withdrawals serve as a drinking water source. There are many more unpermitted withdrawals, some of which are also probably used for domestic purposes (Ken Lustig, Panhandle Health District, oral commun., 1993).

SUMMARY OF 1991-93 LAKE STUDY

OBJECTIVES

The objective of the lake study was to determine the lake's assimilative capacity for nutrients to assess the potential for development of an anoxic hypolimnion and the consequent release of nutrients and trace elements from the lakebed sediments. Seven major tasks were undertaken to achieve the two objectives:

(1) assess physical, chemical, and biological characteristics in the limnetic and littoral zones of the lake;

(2) quantify loadings of water, nutrients and selected trace elements into and out of the lake;

(3) develop a nutrient load/lake response model of the lake;

(4) using the model, simulate responses of the dissolved oxygen deficit to alterations in nutrient loadings;

(5) perform geochemical analyses of lakebed sediments to determine concentration, partitioning, and environmental availability of selected trace elements;

(6) characterize land cover/land use throughout the study area using remote sensing and GIS techniques; and

(7) assemble the data base needed for development of a lake management plan.

The results of the study are discussed in reports by Idaho Department of Water

Resources (1993), Berenbrock and Woods (1994), Horowitz and others (1993, 1994), Kuwabara and others (1994), Woods (1994), and Woods and Beckwith (in press); a summarization follows.

LIMNOLOGY

• Numerous measurements were taken in the lake's open-water (fig. 4) and nearshore areas (fig. 5) to assess the lake's physical, chemical, and biological characteristics.

• Water-column transparency was measured as an index of the lake's biological production. The lake's southern area was less transparent than the central and northern areas (fig. 6), indicating that the southern area was more productive.

• The nutrients nitrogen and phosphorus are important determinants of aquatic plant growth. The amounts of both nutrients were larger in the lake's southern area (tables 7 and 8), indicating a larger pool of nutrients was available for biological production.

• Phosphorus was the nutrient most likely to control the rate of aquatic plant growth because it was in shortest supply relative to the nutritional requirements of the plants (table 9).

• Chlorophyll is an important index of biological production in lakes because it is the pigment aquatic plants use for photosynthesis. The amount of chlorophyll was largest in the southern area of the lake (table 10), indicating a larger potential for biological production.

• Measurements of water-column transparency, nitrogen, phosphorus, and chlorophyll are used worldwide by lake scientists to assess and compare the biological production of lakes (table 11). For Coeur d'Alene Lake, these measurements were typical of oligotrophic, or low productivity lakes (table 12).

• The amount of oxygen dissolved in the deeper areas of a lake can become depleted if the lake is overly productive of aquatic plants. During the majority of the study, Coeur d'Alene Lake had abundant dissolved oxygen. However, the southern area of the lake was severely depleted of dissolved oxygen during the late summer. The northern half of the lake also experienced depletion of dissolved oxygen during the late summer when the lower depths contained about 50 percent of the normal expected amount of dissolved oxygen.

• The large aquatic plants (macrophytes) were mapped to aid in identification of nearshore areas with abundant inputs of nutrients. The southern area of the lake had the most extensive beds of macrophytes, although Cougar Bay, in the northern area, was also heavily populated with macrophytes. The majority of bays with sedimentary deltas at their heads also contained abundant growths of macrophytes.

• Algae during the summer. The microscopic aquatic plants (phytoplankton) throughout most of the lake were essentially devoid of blue-green algae, which are often associated with highly productive lakes. However, the phytoplankton in the lake's southern area contained at least 10 percent blue-green algae.

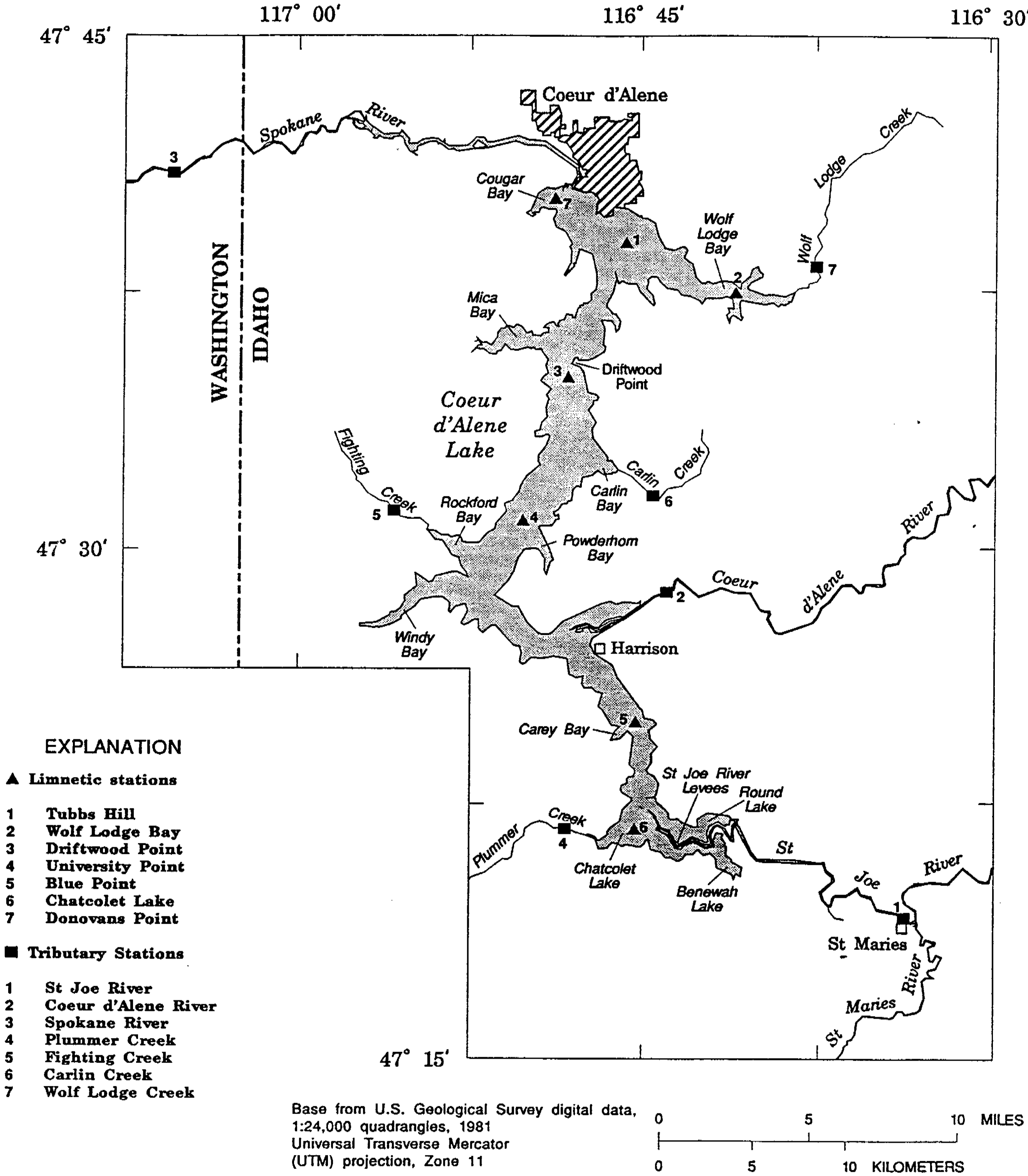

Figure 4. Locations of limnetic and tributary sampling stations.

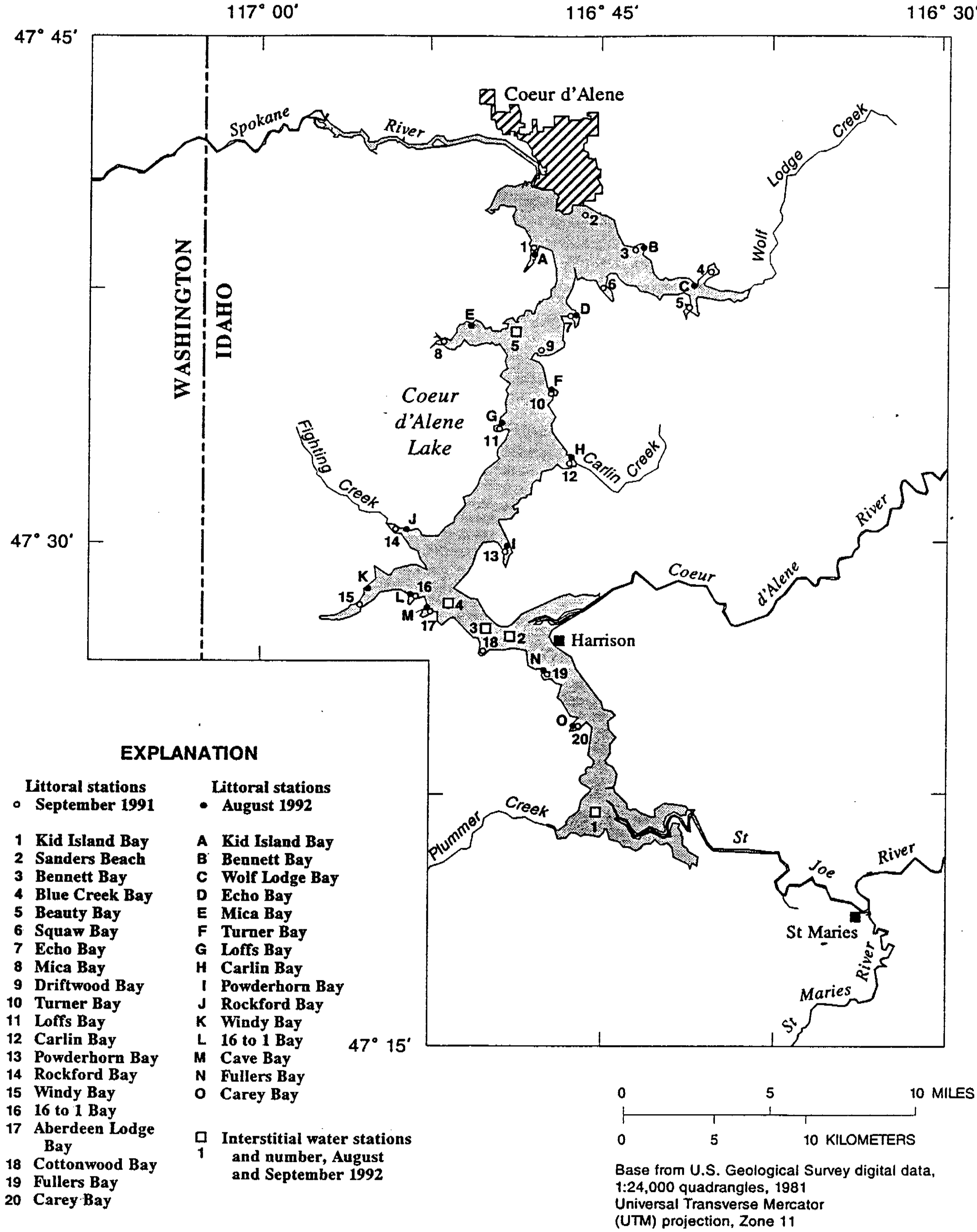

Figure 5. Locations of littoral sampling stations, September 1991 and August 1992, and interstitial water sampling stations, August and September 1992.

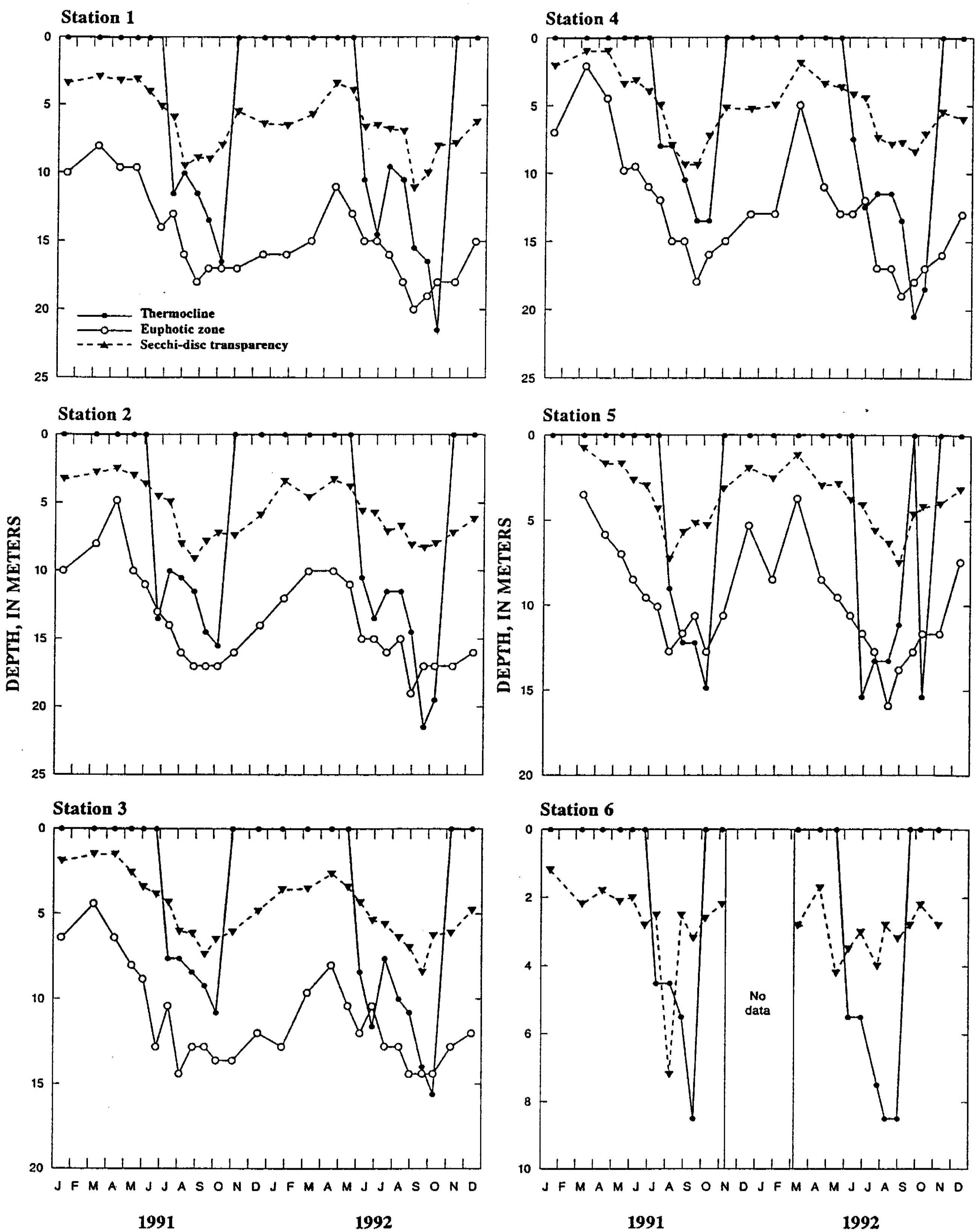

Figure 6. Depths of thermocline, euphotic zone, and secchi-disc transparency at stations 1–6 during 1991–92.

Table 7. Means and ranges of concentrations of total phosphorus and dissolved orthophosphorus in samples from the euphotic zone and near-bottom water at six limnetic stations and lakewide, Coeur d'Alene Lake, 1991–92

[μg/L, micrograms per liter; n, number of samples;<, less than]

Limnetic station (fig. 4)	Total phoshporus (μg/L)						Dissolved orthophosphorus(μg/L)					
	Euphotic zone			Near bottom			Euphotic zone			Near bottom		
	Mean[1]	Range	n	Mean[1]	Range	n	Mean[1]	Range	n	Mean[1]	Range	n
						1991						
1	5.2	1–16	13	4.9	<1– 12	13	1	<1– 1	13	2	<1– 5	12
2	4.4	2–10	13	4.9	<1– 8	12	1.2	<1– 3	13	1.6	<1– 4	12
3	4.6	1– 6	13	4.8	2– 6	13	1	<1– 2	12	1.3	<1– 3	13
4	5.6	<1– 9	13	6.2	3– 10	13	1.2	<1– 2	13	1.5	<1– 3	13
5	8.8	4–17	12	10.1	<1– 21	12	2.3	<1– 7	11	2.3	<1– 7	12
6	14.2	7–41	12	42.1	12–192	8	2.7	<1–11	12	13.6	<1–100	9
Lakewide	6.5	1–41	76	8.1	<1–192	71	1.4	<1–11	74	2.4	<1–100	71
						1992						
1	2.4	<1– 6	13	2.5	<1– 4	13	1	<1– 1	13	1.1	<1– 2	12
2	3.8	<1–10	12	4.8	<1– 25	13	1.1	<1– 2	12	1.6	<1– 8	13
3	2.9	<1–13	13	2.8	<1– 8	13	1.4	<1– 6	13	1.1	<1– 2	13
4	4.2	<1– 8	13	3.7	<1– 8	13	1	<1– 1	12	1.4	<1– 4	13
5	5.0	<1–13	12	5.8	<1– 15	12	1.4	<1– 5	12	1.9	<1– 7	12
6	5.2	<1– 8	9	10.0	7– 17	8	1	<1– 3	9	2.1	<1– 4	8
Lakewide	3.7	<1–13	72	3.8	<1– 25	72	1.2	<1– 6	71	1.3	<1– 8	71

[1]Mean computed by assigning detection limit value to less-than values.

Table 8. Means and ranges of concentrations of total nitrogen and dissolved inorganic nitrogen n samples from the euphotic zone and near-bottom water at six limnetic stations and lakewide, Coeur d'Alene Lake, 1991–92

[μg/L, micrograms per liter; n, number of samples; <, less than; LW, lakewide]

Limnetic station (fig. 4)	Total nitrogen (μg/L)						Dissolved inorganic nitrogen (μg/L)					
	Euphotic zone			Near bottom			Euphotic zone			Near bottom		
	Mean[1]	Range	n	Mean[1]	Range	n	Mean[1]	Range	n	Mean[1]	Range	n
						1991						
1	289	<205–427	13	349	244–631	11	38.3	<7–161	13	102	43–141	13
2	267	<205–409	13	309	229–481	13	32.8	<7–101	13	87.2	35–229	13
3	292	<205–616	13	375	249–902	13	42.2	9–117	13	94.4	30–137	13
4	309	<205–805	13	337	241–887	13	43.3	<7–104	13	102	43–131	13
5	329	<205–808	12	279	<205–459	12	36.6	11–117	12	54.8	14–137	12
6	365	<205–821	12	402	<205–833	8	45.8	8–234	12	84.6	<7–332	9
LW	307	<205–821	76	290	<205–902	70	41.9	<7–234	76	70.8	<7–332	73
						1992						
1	211	<205–221	13	265	222–340	13	19.7	<7–58	13	74.6	28–144	13
2	212	<205–239	12	240	<205–281	13	20.4	<7–47	12	48.7	<6–86	13
3	216	<205–257	13	274	224–316	13	23.2	<7–66	13	84.9	27–123	13
4	220	<205–270	13	273	<205–333	13	27.9	9–76	13	81.7	19–141	13
5	219	<205–287	12	238	<205–334	12	28.0	<7–98	12	50.2	16–153	12
6	206	<205–216	9	258	<205–607	8	15.0	<7–31	9	21.8	<7–48	8
LW	216	<205–287	72	256	<205–607	72	23.8	<7–98	72	56.7	<6–153	72

[1]Mean computed by assigning detection limit value to less-than values.

Table 9. Means and ranges of ratios of dissolved inorganic nitrogen to dissolved orthophosphorus in samples from the euphotic zone at six limnetic stations and lakewide, Coeur d'Alene Lake, 1991–92

[means and ranges in micrograms per liter; LW, area-weighted lakewide value]

Limnetic station (fig. 4)	Ratio Mean	Ratio Range	No. of samples
		1991	
1	38.3	7–161	13
2	30	7–101	13
3	35	9– 81	12
4	38.3	7–104	13
5	20.3	7– 54	11
6	17.1	8– 39	12
LW	34.4	7–161	74
		1992	
1	19.7	7– 58	13
2	19.8	7– 47	12
3	22.8	1– 66	13
4	28.5	9– 76	12
5	20.4	7– 45	12
6	12.8	6– 31	9
LW	22.7	1– 76	71

Table 10. Means and ranges of chlorophyll-*a* concentrations in samples from the euphotic zones at six limnetic stations and lakewide, Coeur d'Alene Lake, 1991–92

[μg/L, micrograms per liter; <, less than; LW, lakewide]

Limnetic station (fig. 4)	Chlorophyll-*a* (μg/L) Mean[1]	Chlorophyll-*a* (μg/L) Range	No. of samples
		1991	
1	0.5	0.1–1	13
2	.5	.2–1.1	13
3	.4	.3–1	13
4	.5	<.1–1	13
5	.6	.3–1.4	12
6	.8	.1–2	11
LW	.5	<.1–2	75
		1992	
1	.6	<.1–1.3	12
2	.8	.4–1.4	11
3	.7	.2–1.2	13
4	.7	.2–1.5	13
5	.9	.2–1.7	13
6	1.1	.1–2.6	11
LW	.8	<.1–2.6	73

[1]Mean computed by assigning detection limit to less-than values.

Table 11. Trophic-state classification based on open-boundary values for four limnological variables

[Modified from Ryding and Rast (1989); µg/L, micrograms per liter; m, meter]

Limnological variable[1]		Oligotrophic	Mesotrophic	Eutrophic
Total phosphorus (µg/L)	$\bar{x}$	8.0	26.7	84.4
	$\bar{x} \pm 1$ SD	4.8–13.3	14.5–49.0	48.0–189.0
	$\bar{x} \pm 2$ SD	2.9–22.1	7.9–90.8	16.8–424.0
Total nitrogen (µg/L)	$\bar{x}$	661	753	1,875
	$\bar{x} \pm 1$ SD	371–1,180	485–1,170	861–4,081
	$\bar{x} \pm 2$ SD	208–2,103	313–1,816	395–8,913
Chlorophyll-*a* (µg/L)	$\bar{x}$	1.7	4.7	14.3
	$\bar{x} \pm 1$ SD	0.8–3.4	3.0–7.4	6.7–31.0
	$\bar{x} \pm 2$ SD	0.4–7.1	1.9–11.6	3.1–66.0
Secchi-disc transparency (m)	$\bar{x}$	9.9	4.2	2.4
	$\bar{x} \pm 1$ SD	5.9–16.5	2.4–7.4	1.5–4.0
	$\bar{x} \pm 2$ SD	3.6–27.5	1.4–13.0	0.9–6.7

[1] Annual geometric mean values and standard deviations.

Table 12. Trophic state of Coeur d'Alene Lake at six limnetic stations and lakewide during 1991 and 1992 based on annual mean values of four limnological variables

[µg/L, micrograms per liter; m, meters; TS, trophic state; O, oligotrophic; M, mesotrophic; E, eutrophic; LW, lakewide]

Limnetic station (fig. 4)	Total phosphorus (µg/L)		Total nitrogen (µg/L)		Chlorophyll-*a* (µg/L)		Secchi-disc transparency (m)	
	[1] $\bar{x}$	TS	[1] $\bar{x}$	TS	[1] $\bar{x}$	TS	[2] $\bar{x}$	TS
1991								
1	4.2	O	275	O	0.39	O	5.3	M
2	3.9	O	259	O	.45	O	4.9	M
3	4.3	O	276	O	.39	O	4.7	M
4	5.0	O	282	O	.38	O	4.0	M
5	8.3	O	290	O	.52	O	3.1	M
6	12.4	O	316	O	.55	O	2.4	M/E
LW	5.6	O	282	O	.43	O	4.0	M
1992								
1	2.0	O	211	O	.54	O	6.6	M
2	2.8	O	212	O	.71	O	5.6	M
3	2.1	O	215	O	.62	O	6.2	M
4	3.6	O	219	O	.62	O	5.2	M
5	3.7	O	218	O	.81	O	4.6	M
6	4.6	O	206	O	.79	O	2.9	M/E
LW	2.9	O	214	O	.67	O	5.1	M
1991–92								
LW	4.1	O	247	O	.54	O	4.5	M

[1] Annual geometric mean concentration within euphotic zone.
[2] Annual geometric mean value.

• The microscopic aquatic plants attached to underwater materials (periphyton) were studied in nine bays to determine if the level of nearshore and watershed development was related to growth rates of periphyton. A strong and positive relation (coefficient of determination = 88.4) was statistically derived between growth rate of periphyton and the amount of phosphorus in the nearshore water and the percentage of agricultural land in the contributing watershed.

• The amount of the trace elements arsenic, cadmium, copper, mercury, and lead in the lake water was very low, whereas, the amount of zinc in the lake water was elevated throughout the northern two-thirds of the lake (table 13). Based on U.S. Environmental Protection Agency criteria, the zinc levels were potentially harmful to freshwater aquatic life (table 14), but not to humans.

• Algal bioassay tests for zinc toxicity indicated that the biologically-available, dissolved zinc concentrations in the northern two-thirds of the lake suppressed the growth of phytoplankton isolated from Coeur d'Alene Lake.

LAKEBED SEDIMENTS

• The phosphorus content of the lakebed sediments was slightly enriched whereas nitrogen was moderately enriched.

• The lakebed sediments in about 85 percent of the lake were markedly enriched in antimony, arsenic, cadmium, lead, mercury, and zinc (table 15). The area of the lake south of Conkling Point was not enriched in trace elements.

• The source of the trace-element enrichment was attributed to the mining, ore-processing, and smelting operations that have occurred since the 1880's in the Coeur d'Alene River watershed. The vast majority of the trace elements were associated with materials operationally defined as iron oxides, not sulfides as previously believed, and thus were quite likely to exist in a dissolved, not particulate, form if the lakebed contained little or no oxygen.

HYDROLOGIC, NUTRIENT, AND TRACE-ELEMENT BUDGETS

• Streamflow into the lake during 1991 was 130 percent of the long-term average, whereas, in 1992, streamflow was only 60 percent of average.

• The lake received over 90 percent of its water inflow from the St. Joe and Coeur d'Alene Rivers, with the St. Joe having the largest inflow (tables 16 and 17).

• During 1991 and 1992, the lake received over one-half of its phosphorus from the St. Joe and Coeur d'Alene Rivers, with the St. Joe as the largest contributor (tables 18 and 19).

• Phosphorus inputs in 1991 were about 2.5 times larger than those in 1992 because of the much larger streamflows of 1991.

• The lake received more phosphorus than it output to the Spokane River, thus, it acted as a trap for phosphorus.

• During 1991 and 1992, the lake received about three-fourths of its nitrogen from the St. Joe and Coeur d'Alene Rivers, with the St. Joe as the largest contributor (tables 18 and 19).

Table 13. Lakewide concentrations of six trace elements in samples from the euphotic zone and lower hypolimnion, Coeur d'Alene Lake, 1991–92

[µg/L, micrograms per liter; <, less than]

Trace element	Concentration (µg/L) Range	Median	Percent of samples below detection limit	No. of samples
Arsenic, total	<1–1	<1	94.5	145
Cadmium, total recoverable	<1–2	<1	97.3	146
Copper, total recoverable	<1–15	1.6	40.0	136
Lead, total recoverable	<1–41	3.3	26.7	146
Mercury, total recoverable	<0.1–1.8	<.1	79.3	145
Zinc, total recoverable	<10–390	98.6	11.0	146

Table 14. Concentrations of selected trace elements considered acutely or chronically toxic to freshwater biota based on hardness-dependent criteria

[µg/L, micrograms per liter; CMC, criterion maximum concentration; CCC, criterion continuous concentration; e, base of natural logarithms; ln, natural logarithm; H, hardness, in milligrams per liter as $CaCO_3$; —, data not available; mg/L, milligrams per liter]

Trace element	Criteria	Toxicity equation[1,2]	Concentration (µg/L) Total recoverable	Dissolved
Arsenic	CMC	None	360	342
	CCC	None	190	180
Cadmium	CMC	$e^{[1.128(\ln H)-3.878]}$	.71	.60
	CCC	$e^{[0.7852(\ln H)-3.49]}$	.35	.30
Copper	CMC	$e^{[0.9422(\ln H)-1.464]}$	4.3	3.7
	CCC	$e^{[0.8545(\ln H)-1.465]}$	.16	.14
Lead	CMC	$e^{[1.273(\ln H)-1.46]}$	11.9	6.0
	CCC	$e^{[1.273(\ln H)-4.705]}$	.5	.12
Mercury	CMC	None	2.4	2.0
	CCC	None	.012	—
Zinc	CMC	$e^{[0.8473(\ln H)+0.8604]}$	32.4	27.5
	CCC	$e^{[0.8473(\ln H)+0.7614]}$	29.4	25.0

[1] From U.S. Environmental Protection Agency (1986).

[2] Hardness is median value for Coeur d'Alene Lake, 1991–92, 22 mg/L as $CaCO_3$.

Table 15. Statistical summary of selected trace elements in surficial and subsurface lakebed sediments in enriched and unenriched areas, Coeur d'Alene Lake

[mg/kg, milligrams per kilogram; S, surficial sample; C, subsurface sample; <, less than; data from Horowitz and others (1993, 1995)]

Trace element	Sample type	Concentration for enriched area (mg/kg)				Median concentration for unenriched area[1] (mg/kg)
		Minimum	Maximum	Mean	Median	
Arsenic	S	2.4	660	151	120	4.7
	C	3.5	845	103	30	12
Cadmium	S	<.5	157	62	56	2.8
	C	<.1	137	25	26	.3
Copper	S	9	215	72	70	25
	C	20	650	91	60	30
Lead	S	14	7,700	1,900	1,800	24
	C	12	27,500	3,200	1,250	33
Mercury	S	.02	4.9	1.8	1.6	.05
	C	<.01	9.9	1.9	0.95	.06
Zinc	S	63	9,100	3,600	3,500	110
	C	59	14,000	2,400	2,100	118

[1] Unenriched area median concentration for sample type S based on 17 samples from southern area of Coeur d'Alene Lake and lower reach of St. Joe River. Unenriched area median concentration for sample type C based on 189 sample aliquots from cores beneath enriched area.

Table 16. Hydrologic budget and errors associated with each budget component, Coeur d'Alene Lake, 1991

[Volumes and errors are in cubic hectometers]

Budget component	Inflow or outflow: Volume	Inflow or outflow: Percent of total	Error
	Inflow		
St. Joe River	3,350	52.4	502
Coeur d'Alene River	2,610	40.8	391
Plummer Creek	22	.3	1.6
Fighting Creek	10.5	.2	.8
Carlin Creek	8.5	.2	.6
Wolf Lodge Creek	57	.9	4.3
Ungaged surface-water inflow	260	4.1	68
Wastewater	6.2	.1	1.5
Precipitation	64.6	1.0	9.7
	Outflow		
Evaporation	93.3	1.5	24.6
Ground-water outflow to Rathdrum Prairie	205	3.1	51.2
Lake storage change	33.6	.06	2.5
Spokane River	6,270	94.8	470
	Summary		
Total inflow	6,390		
Total outflow	6,610		
Residual (outflow - inflow)	220		
Overall error	796		

Table 17. Hydrologic budget and errors associated with each budget component, Coeur d'Alene Lake, 1992

[Volumes and errors are in cubic hectometers]

Budget component	Inflow or outflow: Volume	Inflow or outflow: Percent of total	Error
	Inflow		
St. Joe River	1,660	52.0	300
Coeur d'Alene River	1,280	40.1	200
Plummer Creek	11.4	.4	.9
Fighting Creek	5.5	.2	.4
Carlin Creek	4.5	.1	.3
Wolf Lodge Creek	21.9	.7	1.6
Ungaged surface-water inflow	125	3.9	34
Wastewater	5.5	.2	1.4
Precipitation	75	2.4	11
	Outflow		
Evaporation	98.3	2.8	24.6
Ground-water outflow to Rathdrum Prairie	205	5.8	51.2
Lake storage change	54.3	1.6	4.1
Spokane River	3,140	89.8	236
	Summary		
Total inflow	3,190		
Total outflow	3,500		
Residual (outflow - inflow)	310		
Overall error	436		

Table 18. Nutrient budgets and errors for total phosphorus and total nitrogen, Coeur d'Alene Lake, 1991

[Loads and errors are in kilograms]

Budget component	Total phosphorus Load	Total phosphorus Percent of total	Total phosphorus Error	Total nitrogen Load	Total nitrogen Percent of total	Total nitrogen Error
Inflow						
St. Joe River	72,100	54.3	11,000	1,040,000	45.9	155,000
Coeur d'Alene River	22,000	16.6	3,120	801,000	35.3	121,000
Plummer Creek	2,060	1.6	180	38,000	1.7	3,460
Fighting Creek	610	.5	60	12,500	.6	1,190
Carlin Creek	205	.1	20	2,820	.1	330
Wolf Lodge Creek	590	.4	40	18,600	.8	1,320
Ungaged surface-water inflow	8,750	6.6	2,040	153,000	6.7	40,100
Wastewater	19,900	15.0	6,400	127,000	5.6	42,400
Precipitation	6,460	4.9	1,000	75,000	3.3	11,500
Outflow						
Ground-water outflow to Rathdrum Prairie	5,940	11.1	1,530	122,000	5.8	30,600
Lake storage change	410	.8	30	8,140	.4	720
Spokane River	47,600	88.1	3,760	2,020,000	93.8	150,000

Summary

Total phosphorus	Total nitrogen
Total inflow = 133,000	Total inflow = 2,270,000
Total outflow = 54,000	Total outflow = 2,150,000
Residual (outflow-inflow) = -79,000	Residual (outflow-inflow) = -120,000
Overall error = 13,900	Overall error = 256,000

Table 19. Nutrient budgets and errors for total phosphorus and total nitrogen, Coeur d'Alene Lake, 1992

[Loads and errors are in kilograms]

Budget component	Total phosphorus Load	Total phosphorus Percent of total	Total phosphorus Error	Total nitrogen Load	Total nitrogen Percent of total	Total nitrogen Error
Inflow						
St. Joe River	18,300	33.3	3,300	418,000	41.0	75,000
Coeur d'Alene River	9,980	18.1	1,600	314,000	30.8	49,000
Plummer Creek	1,130	2.1	100	21,900	2.1	1,920
Fighting Creek	410	.8	70	8,210	.8	1,490
Carlin Creek	106	.2	20	1,480	.2	330
Wolf Lodge Creek	217	.4	20	6,860	.7	620
Ungaged surface-water inflow	4,990	9.1	1,360	89,200	8.7	24,100
Wastewater	13,400	24.4	2,400	85,100	8.3	14,200
Precipitation	6,460	11.6	1,100	75,000	7.4	11,000
Outflow						
Ground-water outflow to Rathdrum Prairie	7,590	19.4	2,040	153,000	16.4	38,200
Lake storage change	200	.6	40	11,700	1.2	880
Spokane River	31,300	80.0	2,360	770,000	82.4	57,800

Summary

Total phosphorus	Total nitrogen
Total inflow = 55,000	Total inflow = 1,020,000
Total outflow = 39,000	Total outflow = 935,000
Residual (outflow-inflow) = -16,000	Residual (outflow-inflow) = -85,000
Overall error = 5,660	Overall error = 117,000

• Nitrogen inputs in 1991 were about twice as large as those for 1992.

• The lake did not act as a trap for nitrogen because inflow was about equal to outflow.

• The contribution of nutrients to the lake from private and municipal wastewater-treatment systems was dominated by the wastewater treatment plant at Page, which contributed 66 percent of the total phosphorus and 72 percent of the total nitrogen from such sources (table 20).

• The Coeur d'Alene River was the primary contributor of arsenic, cadmium, lead and zinc to the lake, with the 1991 input of zinc being the largest at 847,000 kilograms (930 tons).

• The lake acted as a trap for arsenic, cadmium, lead, and zinc.

NUTRIENT LOAD/LAKE RESPONSE MODEL

• The model divided the lake into six segments (fig. 7) in order to test the response of the individual lake segments to nutrient management scenarios.

• The nutrient load portion of the model accounted for the input or output of water and nutrients from 59 sources such as surface water inflow and outflow, precipitation and evaporation, private and municipal wastewater treatment systems, urban runoff, and groundwater.

• The lake response portion of the model accounted for the amount and movement of water and nutrients throughout the lake in order to assess how the lake responds physically, chemically, and biologically to changes in water and nutrient loadings.

• A wide variety of simulations was possible owing to the complexity of Coeur d'Alene Lake and its drainage basin, as well as the diversity of possible water quality management options. Simulations addressed two major questions: (1) would large increases in nutrient loadings cause the lake's hypolimnion to become anoxic, and (2) would the lake's water quality be substantially improved by large reductions in nutrient loadings.

• Simulations have indicated the northern two-thirds of the lake has a large capacity to receive additional inputs of nutrients before the hypolimnion becomes severely depleted of dissolved oxygen.

• The simulated removal of all wastewater generated nutrient loadings improved lake water quality more than the simulated nutrient reductions resulting from implementation of best management practices for forestry and agriculture within the Coeur d'Alene and St. Joe River basins.

TRENDS IN LAKE WATER QUALITY

• The National Eutrophication Survey, conducted on Coeur d'Alene Lake during 1975, found the lake to be mesotrophic, or moderately enriched, based on information on nutrients, chlorophyll, dissolved oxygen depletion, and the incidence of blue-green algae (U.S. Environmental Protection Agency, 1977).

• The nutrient budgets developed by the National Eutrophication Survey were compared to the 1991 nutrient budgets (table 21); loadings of nitrogen and phosphorus in

Table 20. Annual loads of total phosphorus and total nitrogen to Coeur d'Alene Lake from nearshore and municipal wastewater-treatment systems, 1991 and 1992

[kg, kilograms; TP, total phosphorus; TN, total nitrogen; WWTP, wastewater-treatment plants]

Load source (fig. 1)	Annual load for 1991 and 1992 (kg)		Percent contribution to annual load for 1991 and 1992 (kg)	
	TP	TN	TP	TN
Nearshore[1]	390	4,900	4.7	8.7
Municipal WWTP				
Clarkia	20	315	.3	.6
Santa/Fernwood	60	320	.7	.6
St. Maries	1,400	3,720	17.1	6.6
Plummer	290	1,560	3.5	2.8
Mullan	310	2,550	3.8	4.6
Smelterville	225	1,550	2.7	2.8
Page	5,400	40,500	65.7	72.5
Harrison	120	450	1.5	.8
Total	8,220	55,900	100.0	100.0

[1]Sum of private, community, and commercial wastewater-treatment systems within 150 meters of lake shoreline.

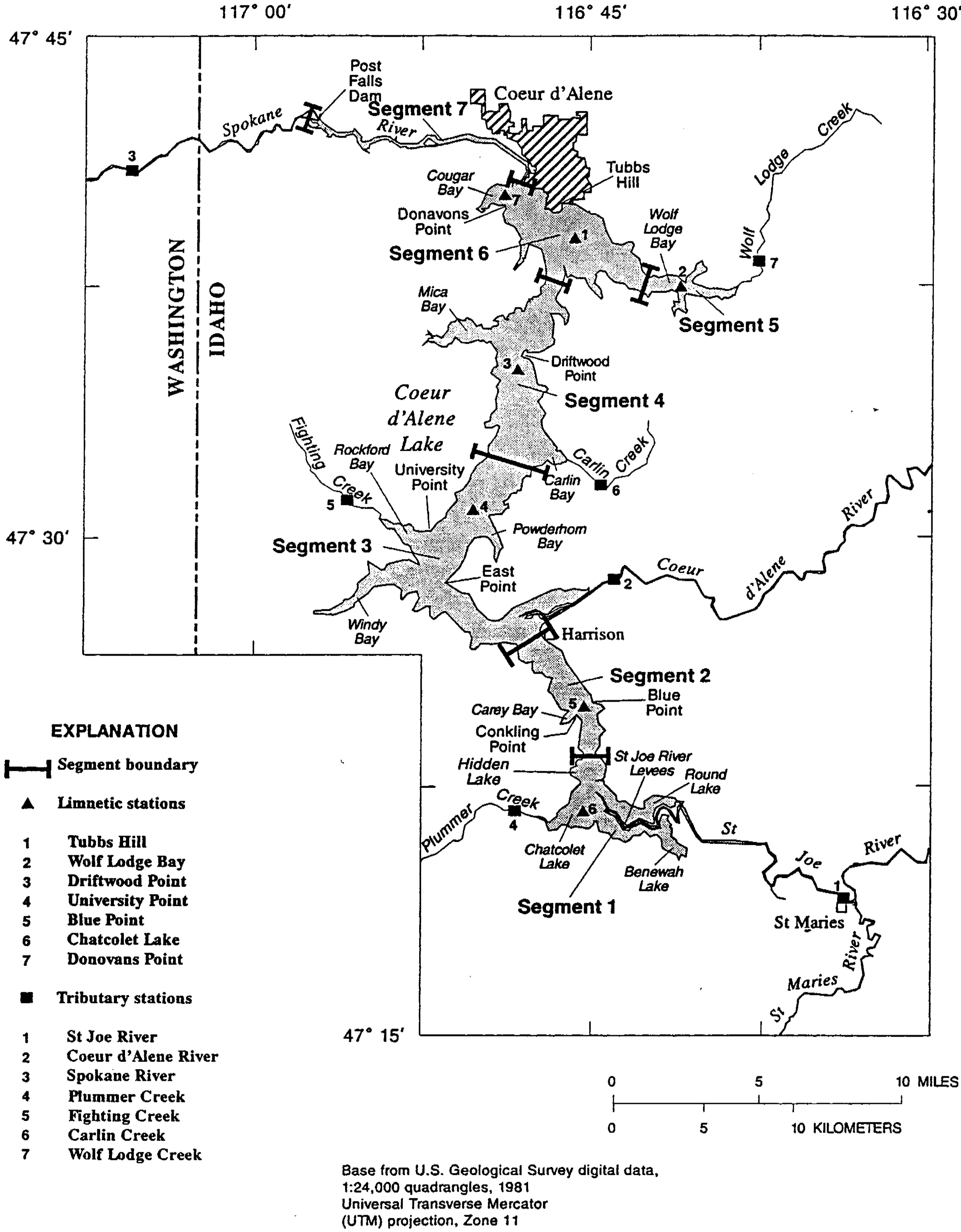

Figure 7. Segmentation of Coeur d'Alene Lake for nutrient load/lake response model.

1975 were twice what they were in 1991 (when loadings are based on equivalent streamflows for both years). - In 1975, the Coeur d'Alene River was the principal contributor of phosphorus; in 1991, it was the St. Joe River.

- In 1975, the Coeur d'Alene and St. Joe Rivers contributed nearly equal amounts of nitrogen; in 1991, the St. Joe River was the principal contributor.

- These substantial reductions in nutrient loadings have allowed Coeur d'Alene Lake to improve from mesotrophic to oligotrophic over the course of about 15 years.

- Reductions in nutrient loads are attributable to the cumulative effects of numerous actions. Two of the more visible actions were the closure of the phosphorous plant at the Bunker Hill complex and the diversion of untreated domestic wastewater to municipal wastewater treatment plants.

- Less quantifiable reductions in nutrient loads have accrued because of recent implementation of best management practices for timber harvest and agricultural activities.

- The recent improvement in water quality applies primarily to the deep, open lake area north of the mouth of the Coeur d'Alene River; the shallow, southern area of the lake has not shared equally in this improvement.

Table 21. Loads of total phosphorus and total nitrogen to Coeur d'Alene Lake, 1975 and 1991

[kg, kilograms; TP, total phosphorus; TN, total nitrogen]

Load source	1975 loadings[1] (kg)		1991 loads[2] (kg)	
	TP	TN	TP	TN
Coeur d'Alene River........	98,100	1,490,000	11,000	572,000
St. Joe River.....................	56,300	1,480,000	54,000	794,000
Other[3]...............................	25,600	430,000	25,000	234,000
Total load to lake.......	180,000	3,400,000	90,000	1,600,000

[1]From U.S. Environmental Protection Agency (1977); loadings based on long-term annual mean discharge.

[2]Measured 1991 loads reduced by 30 percent to estimate loadings at long-term annual mean discharge.

[3]Includes minor tributaries, nearshore septic tanks, direct precipitation to lake surface, and wastewater-treatment plants.

LAKE MANAGEMENT PLAN

INTRODUCTION

The lake management plan has been developed in three major stages. At first, a lake management plan workgroup used the results of the 1991-93 lake study to identify water quality issues and suggest potential goals and methods for management of the lake's water quality. Then, intensive program of public involvement and education was undertaken to encourage the public to select their preferred goals and management actions. The preferred goals and management actions were then written. An environmental evaluation was prepared to discuss the positive and negative effects of the preferred management actions. A monitoring plan was designed to assess the effectiveness of the management actions for attaining the management goals.

LAKE MANAGEMENT PLAN WORK GROUP

The Lake Coeur d'Alene Management Plan development was steered by a committee of representatives of Division of Environmental Quality (DEQ), Coeur d'Alene Tribe, Clean Lakes Coordinating Council (CLCC), US Geological Survey (USGS) and Commissioners of Kootenai, Benewah and Shoshone Counties. The lake management plan workgroup prepared a document entitled, "Draft Coeur d'Alene Lake Management Plan" and released it for public comment in April, 1994 (Coeur d'Alene Basin Restoration Project, 1994).

A major goal of that document was to illustrate the connection between the technical results of the 1991-93 lake study and the management approach developed by the lake management plan workgroup. Another goal was to identify and discuss other water quality oriented studies or activities within the basin so they could be integrated into the lake management planning process. The draft did not make specific recommendations as to water quality management goals and methods pending the public's opportunity to comment on the draft. A summarization of the April, 1994 draft's major points follows.

TRENDS IN LAKE WATER QUALITY

Coeur d'Alene Lake's water quality has improved during the last 15-20 years. This positive trend is attributable to the enactment of environmental laws by federal, state and local governments, and a growing societal awareness of environmental issues. As result, settling ponds for mining and smelting wastes were installed in the late 1960's and effective sewage treatment began in the Silver Valley in the mid-1970's and into the 1980's. State and local standards for subsurface sewage disposal were also made more stringent. State laws now require the use of best management practices (BMPs) for reducing water quality effects of timber harvest activities. Encouraged by economics, as well as by state and federal programs, agricultural practices that reduce erosion and sedimentation have also come into more widespread use. All of these factors, along with a growing environmental awareness and the transition to an economy less dependent on natural resources extraction, have contributed to the recent improving trend in water quality in Coeur d'Alene Lake.

Although Coeur d'Alene Lake has become visibly "cleaner" in recent years, the potential still exists for serious and widespread water quality degradation given present trends in population growth and lake use coupled with the extent of past pollution. Significant depletion of dissolved oxygen still occurs in deep, bottom waters during the late summer. The shallow, southern lake area and several bays are becoming shallower because of sediment eroded from agricultural and timber lands as well as from nearshore areas being developed for residential and recreational uses. These same waters are becoming infested with aquatic plants.

Excessive growth of attached algae can be seen on shoreline rocks, docks, and boats in some nearshore areas. Sewage treatment facilities in the basin still contribute a sizable portion of the lake's potentially controllable nutrient load. The bed and banks of the lower reaches of the Coeur d'Alene and St. Joe Rivers continue to be eroded and transport heavy loads of sediment and nutrients into the lake. Much of the bottom of the lake is blanketed with sediment containing high levels of heavy metals as well as substantial amounts of nutrients. Contaminated wastes from past mining in the Coeur d'Alene River drainage continue to flow into the lake in significant amounts.

Perhaps the greatest threat to Coeur d'Alene Lake is the potential for reversal of the recent improvements in water quality. Such a reversal could be brought on by the rapid increases in lake use, population growth, and land development now occurring throughout the basin. Unless preventative measures are initiated soon, the recent improvements in lake water quality could be eroded or lost.

WATER QUALITY MANAGEMENT ZONES

Viewed as a whole, Coeur d'Alene Lake exhibits relatively high water quality. Yet both the lake study data and public and agency perceptions reveal specific geographic areas of concern and specific water quality issues. It is not appropriate to apply a single water quality management strategy to the whole lake or watershed. Therefore, the lake has been divided into four water quality management zones. Each zone focuses on specific water quality management issues, goals, and management approaches pertinent to that zone. The four water quality management zones include:

1) the nearshore zone (water depths less than 20 feet);

2) the shallow, southern zone which is south of the mouth of the Coeur d'Alene River, and includes the shallow lakes (Benewah, Chatcolet, Hidden, and Round);

3) the lower reaches of the Coeur d'Alene and St. Joe Rivers that are affected by backwater from Coeur d'Alene Lake; and

4) the deep, open water zone which is north of the mouth of the Coeur d'Alene River.

The Spokane River arm of the Coeur d'Alene Lake is not included as a zone because its management is being addressed by a phosphorus load allocation study being conducted by Idaho Division of Environmental Quality. The 1991-1993 lake study included data collection on the Spokane

River arm, but only to quantify its contribution to hydrologic and nutrient budgets being discharged through Post Falls Dam.

There are specific tributary watersheds that were identified as needing special attention. The identification came from public and agency comments as well as from analyses of nutrient loading data generated by the lake study. These areas include, but are not limited to, the following:

- lower St. Joe River
- St. Maries River
- upper St. Joe River
- nearshore area, Harrison to St.Maries
- Benewah Creek
- Plummer Creek
- Lake Creek
- nearshore area, Windy Bay to Chatcolet Lake
- nearshore area, Windy Bay
- Fighting Creek
- Cougar Creek
- nearshore area, Mica Bay to Cougar Bay
- lower Coeur d'Alene River

WATER QUALITY MANAGEMENT GOALS

Each of the four water quality management zones has the following potential water quality management goals from which to select:

1) improve water quality slowly (low cost management alternatives); and

2) improve water quality rapidly (high cost management alternatives).

Selection of a water quality management goal for each water quality management zone must consider the applicable Idaho and federal water quality criteria and standards. The Idaho Water Quality Standards and Wastewater Treatment Requirements designate the appropriate beneficial uses of Idaho's waters and list specific water quality criteria to be used to determine if a beneficial use is fully supported by the water quality conditions of the subject water body. Federal Standards and criteria are used directly only by reference in the Idaho Standards.

All four management zones experience conditions which exceeded of water quality standards for at least one contaminant; therefore, a goal to maintain the current water quality condition is not a legally viable goal. A "No Action " goal (that is, not taking additional water quality management actions other than are currently being taken) was not considered because, given the current level of activities within the Coeur d'Alene Lake basin, lake water quality is likely to deteriorate unless mitigative actions are implemented.

The public chose the slow improvement option as the goal for the plan.

PUBLIC INVOLVEMENT AND EDUCATION

The lake management plan workgroup recognized the need to involve the public in the decision making process because, without public input and support, implementation of the chosen management goals and methods would be difficult. A public involvement and education plan was written in December, 1993 with the following three goals:

(1) generate support and input for the plan and subsequent implementation from all

stakeholders;

(2) educate the public about existing lake conditions; what the public can do to help, and what agencies are doing to help; and

(3) meet the requirements for public involvement and education under the Idaho Nutrient Management Act, Idaho Clean Lakes Act, and the federal Clean Lakes program.

To achieve the three goals, the lake management plan workgroup employed the following five strategies:

(1) public meetings,

(2) community presentations,

(3) monthly updates/fact sheets,

(4) media relations, and

(5) technical advisory groups.

PUBLIC MEETINGS

Two sets of public meetings were conducted prior to the development of the initial draft of the lake management plan. A third set of public meetings were conducted in late 1994 to present a complete draft of the lake management plan. A public hearing was conducted in 1995 to consider adoption of the final version of the lake management plan in 1996.

The first round of public meetings was in July 1993 at four locations within the basin: Coeur d'Alene (two meetings), St. Maries, Kellogg, and Plummer. Following a short summarization of results from the 1991-93 lake study, participants were asked about their concerns and management priorities for Coeur d'Alene Lake. At each meeting, the participants broke into groups to list and prioritize their concerns. A summary of the concerns expressed at this round of meetings (Appendix B) has helped to guide the lake management plan workgroup.

The July 1993 meetings raised two issues not previously addressed by the lake management plan workgroup. More involvement by local government was requested. In response, county commissioners from Benewah, Kootenai, and Shoshone Counties became members of the lake management plan workgroup in order to help set the agenda for the lake management plan. The lower reaches of the Coeur d'Alene and St. Joe Rivers were added as a water quality management zone.

The second round of public meetings was in April 1994, in Coeur d'Alene, Kellogg, St. Maries, Worley, and Spokane. During these meetings, a more detailed summary of the lake study was presented, as well as explanations of the four water quality management zones and the overall planning process. The public was asked to help the lake management plan workgroup set goals for the long term management for each of the four zones. Questionnaires with a list of management choices were distributed prior to a question and answer session. Of the attendees, 76 turned in completed questionnaires. The summary of the completed questionnaires (Appendix D) has been used in development of the lake management plan.

The questionnaires from the April 1994 meetings indicated the public wanted a "go slow" approach to lake management. The public did not want expensive "in-lake" methods applied to existing problems. With the advent of environmental laws, the lake has slowly improved over the past 20 years; the public wanted to see that trend continue in most areas. However, many comments were raised about pollution problems in specific areas, such as the southern lake and the erosion of river banks.

A series of five public meetings considered the draft Coeur d'Alene Lake Management Plan during November 1994. The meetings were in Coeur d'Alene, Kellogg, St. Maries, Plummer and Post Falls at the beginning of a planned 45 day comment period. Comments on the plan were solicited with comment forms. Letters of comment were encouraged. At the request of the Coeur d'Alene Basin Restoration Project's citizen's advisory committee and the general public, the comment period was extended an additional 30 days. Thirty-three written comments concerning the plan were received. Letters of response were sent to each individual who provided written comment. The comments and the response letters are exhibited in appendix E.

COMMUNITY PRESENTATIONS

To generate public awareness and support for the lake management plan, 30-minute presentations were made to 20 community, business, professional, and other groups during their regularly scheduled meetings. A short summary of the lake study findings and the lake management planning process was presented. Similar presentations were made to the following advisory groups associated with the Coeur d'Alene Basin Restoration Project (CBRP): Coeur d'Alene Basin Interagency Group (CBIG), Citizen's Advisory Committee for CBRP, and Management Advisory Committee for CBRP.

An information booth was used to distribute fact sheets, questionnaires, and to show a 10-minute video presentation at the Spokane Boat Show and the Coeur d'Alene Silver Lake Mall's "Community Days" in February 1994. The booth was staffed throughout both events to provide information and answer questions about Coeur d'Alene Lake and its developing lake management plan.

MONTHLY UPDATES/FACT SHEETS

Written information was also produced as part of the educational effort. They mailed a two-page Monthly Update to about 400 addresses beginning in March 1994 to regularly inform them of the progress on the lake management plan. Fact Sheets were also written to summarize the lake study results and the lake management planning process. These have been distributed during the public meetings and community presentations and have been used to satisfy requests. A summary of the lake management planning process was included in a newsletter published by a real estate company for mailing to waterfront homeowners in the Inland Northwest.

MEDIA RELATIONS

Press conferences in December 1993 and April 1994 briefed the media about the lake study results and promote the lake management plan. Articles appeared in the local and regional newspapers and news reports were aired on three local television stations.

Paid advertisements in local and regional newspapers announced the dates and location of the public meetings in July 1993, April 1994 and November 1994. The meetings also were announced via the "Community Calendar" services provided by local newspapers and radio and television stations.

TECHNICAL ADVISORY GROUPS

The principal method to involve the public in the lake management planning process was the formation of five technical advisory groups (TAGs). The five TAGs were formed to discuss the water quality issues, goals, and management actions associated with the following topics: forest practices, agriculture, development (with a recreation subgroup), southern lake, and rivers. More than 80 people participated in the TAGs; they represented local, state and federal agencies, industry, environmental organizations, plus community and business associations. Each group had a facilitator who was a member of the lake management plan workgroup.

An orientation meeting in April 1994 provided an overview of the lake study results and educated the TAG members about their role in the lake management planning process. At that meeting, the TAGs were advised of the management goals for each of the four management zones (selected during the April 1994 public meetings). Each TAG then met separately over the next several months. Each studied their water quality issues and developed management action suggestions. Each TAG reviewed and commented upon the management actions proposed by the other TAGs. All TAG meetings were open to the public. The lake management recommendations of the TAGs were incorporated into this final draft lake management plan, provided they fell within established legal constraints.

REGULATORY FRAMEWORK FOR MANAGEMENT OF POINT AND NONPOINT SOURCES

Many of the management actions recommended in Tables 22 to 30 seek to limit inputs of nutrients and sediments from point and nonpoint sources. Some of the management actions are already included within the current regulatory framework designed to manage these sources.

Point sources of nutrients are wastewater treatment facilities and confined animal feeding operations. These sources are managed under the federal Clean Water Act (CWA) through the National Pollutant Discharge Elimination System (NPDES) program as major and minor sources, respectively. Major sources are permitted with restrictions protective of the water, while minor sources must develop and implement a pollution abatement plan protecting water. The NPDES program is administered in Idaho by EPA with the state providing assurance that discharges allowed will meet state water quality standards.

Nonpoint source management occurs under an array of federal, state and local programs. Planning to address nonpoint sources of pollutants began with the inclusion of section 208 in the 1978 re-authorization of the CWA. Statewide nonpoint source management plans and funds for demonstrating projects were provided by section 319 of the 1987 re-authorization. Decision on the approaches to nonpoint source management in Idaho have been primarily made at the state level by the executive and legislative branches. Recent federal farm legislation has increased use of nonpoint source control practices in agriculture.

Agriculture activities which abate water quality impacts are managed under the state Agricultural Water Quality Program (SAWQP). SAWQP is a voluntary program in which state funds are used to cost share with farmers for installation of improvements which will reduce erosion and limit sedimentation and nutrient release. Farmers pay 25-100 percent of the cost of a practice either out of pocket or as "in-kind" labor. Although SAWQP is voluntary, federal farm legislation (Food Security Act of 1990) requires farmers to develop a farm conservation plan which addresses the most erodible acres and requires minimum crop wastes to be left to protect the soil. These measures are required in order to qualify the farmer for crop support payments. The same body of legislation provides for the Conservation Reserve Program (CRP) which pays a subsidy for the removal of highly erodible acres from crop production.

Forest harvests are regulated for water quality impacts on all forest lands within the state by the Idaho Forest Practices Act. Rules and regulations promulgated by the state Land Board are designed to limit erosion from forest soils and the accompanying yield of nutrients. Compliance with these best management practices (BMPs) is referenced in the state water quality standards as compliance with the CWA. In order to harvest timber and sell logs these practices must be met as a matter of law. The Department of Lands (IDL) maintains a staff of 3.5 forest practice advisors in the Coeur d'Alene Lake Basin to inspect forest harvest projects and enforce the rules. Installation of the structural BMPs designed to protect water quality is a harvest expense.

Surface mining operations are governed by the Surface Mining Act. A set of rules and regulations have been promulgated by the Land Board to implement the act. The rules are the BMPs for abatement of water quality impacts from surface mining activities. Inspections of surface mining operations are conducted by IDL and rules are enforced. Currently, IDL has one inspector assigned to the Coeur d'Alene Lake Basin.

Regulation of nonpoint source impacts of development other than centralized sewage treatment are largely delegated to the counties, cities and health districts by the Subdivision Act and the Public Health District Act of 1970. The Panhandle Health District reviews and approves plans for installation of on-site wastewater treatment systems. Some counties and cities review and approve ordinances to regulate planning and zoning, building permits, set back requirements and stormwater. The construction and maintenance of county, city and many private roads could be regulated in the same way. Highway districts work with the Idaho Department of Transportation (IDT) to manage highway construction activities. A set of voluntary road construction and maintenance BMPs have been developed by IDT and DEQ to address the nonpoint source impacts of these activities. Projects which potentially cause nonpoint source pollution absorb the cost of nonpoint source controls with fees and/or increased construction costs.

MANAGEMENT ACTIONS PER TECHNICAL ADVISORY GROUPS

FOREST PRACTICES

The Forest Practices TAG included a mix of federal, state, tribal, private forestry and hydrology experts plus a local environmental group representative. A wide ranging list of issues was initially generated, followed by detailed discussion of each. Of 22 issues reviewed by this group, 11 were retained as specific recommendations for the lake plan. The remaining 11 items were dropped from further consideration and no specific actions or recommendations were developed. (More details on the entire list of 11 issues are available from the lake planning team, upon request).

This TAG group recognized that there have been improvements in Coeur d'Alene Lake's water quality over the past 15 years, coinciding with implementation of forestry best management practices (BMPs) and the continuing trend toward strengthened BMP regulations under the Idaho Forest Practices Act (FPA). It is the consensus of the Forest Practices TAG that Idaho's existing FPA, antidegradation feedback loop, and effectiveness monitoring processes provide the best current mechanisms for meeting the objective of "slow-improvement" in Coeur d'Alene Lake water quality. In addition, there are other forest practices issues such as education, enforcement, and cooperative planning that should be addressed to strengthen effectiveness of existing programs.

Specific BMPs and other lake management suggestions that received general consensus from participating forest practices TAG members are listed in Table 22.

AGRICULTURE

The agriculture TAG began with a discussion of mission and roles as well as operating guidelines. The first meetings were presentations from the various agriculture agencies on the existing programs. Topics discussed were Idaho Agricultural Pollution Abatement Plan; the various technical, financial, and educational assistance programs; past and present Coeur d'Alene Basin agricultural water quality projects; as well as lists of Best Management Practices (BMPs) being used in the Coeur d'Alene Basin to protect and improve water quality. The group was presented the most recent findings of the lake water quality monitoring results.

With that background, the group was asked to formulate specific management alternatives to restore and maintain water quality in the Coeur d'Alene Basin. Early in the discussion the group agreed to use existing technical, financial, and educational programs to treat agricultural lands in the watershed as a whole, and did not prioritize specific sub-watersheds for treatment.

The group was given lists of management alternatives from the Hayden, Pend Oreille, and Twin Lakes Lake Management Plans. From those lists the group discussed various alternatives and iterations of alternatives to arrive at a final draft list. Management actions recommended for agriculture are listed in Table 23.

Several participants suggested changing the use of agricultural BMPs to improve and protect water quality from a voluntary to a mandatory program. Those suggestions are omitted because the Idaho Agriculture Abatement Plan signed by the Governor and

Table 22. Management actions recommended by forest practices technical advisory group.

Management Actions	Priority	Lead	Estimated Cost	Funding Sources
Action 1: Adopt minimum 30' Stream Protection Zone (SPZ) for all CDA basin streams not capable of supporting significant fisheries (Class II).	2	IDL	Minimal	IDL
Action 2: Implement pre-operation inspection for all proposed timber harvest and related road construction.	1	IDL	$75,000/yr	IDL
Action 3: Streamline stream alteration permit process; make application procedure less time-consuming and more user-friendly to foster compliance.	2	IWR	Minimal	IWR
Action 4: Develop more prescriptive stream-crossing and stream alteration BMPs that provide a high level of water quality protection from road sediments. Promote more administration and/or enforcement of the Stream Alteration Act within the basin for crossing, alteration proposals.	2	IWR IDL	Minimal	IWR,IDL
Action 5: Add one additional full time FPA administrator in the basin to IDL staff, to inspect forest practices and enforce the FPA rules and regulations.	1	IDL	60,000/yr	Legislature
Action 6: Include intensive, continuous Information and Education program in lake plan that is aimed at forestland owners, loggers, road contractors, having demonstration sites for state-of-the-art forest management.	3	IDL, U of I C.E.S	20,000	IDL, Forest Industry
Action 7: Adopt Idaho FPA proposed "Cumulative Watershed Effects" process and implement it. Train public and operators in its use.	1	IDL, legislature	$8,000-$15,000 Watershed	
Action 8: Minimize road construction impacts in basin by cooperating on joint access development to forest stands.	3	All landowners	Minimal	
Action 9: Secure necessary funding to meet present and future maintenance needs on forest roads.	1	IDL Counties, USFS, BLM Industrial Forestland Owners		USFS,BLM, IDL, Legislature, Forest Industry
Action 10: Encourage landowners to manage forestlands to minimize potential water quality impacts of high-intensity wildfire while maintaining other resources.	3	All landowners		

Action 11: Idaho FPA Advisory Committee should review current state of FPA compliance and enforcement; develop recommendations for additional compliance incentives.	2	IDL, FPAAC,Id Land Board	Minimal	

Table 23. Management actions recommended by agriculture technical advisory group.

Pollution Management Actions **Goal: Reduce non point source pollution from agriculture lands by increasing the voluntary implementation of BMPs* on cropland, hayland, pasture and confined animal feeding areas in order to reduce the amount of sediment, nutrients, pesticides and bacteria reaching Coeur d'Alene Lake and its tributaries.**	Priority	Lead	Estimated Cost	Funding Sources
Action 1: Continue to aggressively encourage voluntary implementation of BMPs through existing SCD, SCS and ASCS programs.	1	SCD	$20K	County State
Action 2: Focus attention on those tributaries which produce high levels of nutrients, sediment, pesticides and bacteria from agricultural sources.	1	SCD	N.A.	N.A.
Action 3: Encourage Soil Conservation Districts to apply for state Agricultural Water Quality Program planning and implementation grants on priority Stream Segments within the Coeur d'Alene Lake Basin. Coordinate with CdA Tribe on reservation lands.	1	SCD	$100k/Plan $1M/imp	WPCA; Farmer match
Action 4: Conduct a River Basin Study of the St. Joe River sponsored by the Benewah Soil Conservation District and carried out by the USDA agencies.	1	SCD	$225K	USDA
Action 5: Make structural sediment and erosion control practices high priority for all current and future agriculture programs and projects which supply financial and/or technical assistance to agricultural producers. These practices should be tied to vegetation improvements, i.e., grassed waterways and riparian planting.	1	SCD	N.A.	N.A.
Action 6: Continue existing cropland management practices through aggressive implementation of federal Farm Bill requirements and other programs.	1	SCD	N.A.	N.A.
Action 7: Implement an aggressive information and education program within the basin to increase agricultural producer's and the general public's knowledge of the technical and financial assistance available for BMP installation and the benefits to the lake, the land and the producer when BMPs are installed and maintained. Included in the Information and Education program should be the demonstration of new technology and management practices. Encourage On Farm Testing.	1	CES SCD CBRP	$35K	CES SAWQP CBRP
Action 8: Provide assistance to hobby farms which are impacting water quality; provide them with livestock management BMPs.	1	CES CBRP		SCD
Action 9: Provide technical and financial assistance to confined animal feeding operations to implement livestock BMPs.	2	SCD		SCD

Action 10: Restore natural vegetation buffers along creeks and drainageways to minimize runoff from adjacent lands through education and/or seek tax incentives for placing in reserve.	1	SCD SCS County		County
Action 11: Implement water quality monitoring to determine effectiveness of agricultural BMP installation and maintenance on SAWQP streams.	1	DEQ	$30K	WPCA
Action 12: Request that ASCS approve Benewah County for participation in Integrated Crop Management program.	1	ASCS		ASCS ACP
Action 13: Encourage zoning ordinances that preserve land for agricultural use.	2	County		County
Action 14: Identify and provide technical assistance for streambank stabilization for streams in agricultural areas.	2	Private SCD Tribe		ACP

Notes:

Action 4. River Basin Studies quantify the production of sediment and nutrients from land uses within the study area in order to identify potential remediation actions to reduce production of sediment and nutrients from erosional processes.

* As defined by the SCS Field Office Technical Guide and the Idaho Agricultural Pollution Abatement Plan.

approved by EPA recognizes the most effective approach to control pollution from agricultural lands is one of strong technical and financial assistance supported with an effective information and education program. Farmers receiving financial assistance are bound by contractual agreement with the funding agency to implement mandatory BMPs. The group recognized that changes from a voluntary program to a strictly mandatory will require changes in state law.

DEVELOPMENT: STORMWATER, ROADS, WASTEWATER AND MISCELLANEOUS TOPICS

Effective management of stormwater from developed and developing areas was a high priority for the TAG which drafted this section of the Lake Management Plan. Though there is no monitoring data for runoff from residential/commercial areas in the Coeur d'Alene Basin, data from other regions suggest that phosphorus export from developed areas is typically one to two orders of magnitude (10-100 times) greater than undeveloped areas, with even higher export rates for areas under construction.

Education and regulation are the key components of this section of the plan. Education is needed because many do not understand the effects of uncontrolled stormwater and erosion/sedimentation on water quality. Increased regulation, including performance standards, and "no net increase" requirements, is needed to create a level playing field for builders and developers, and to ensure that stormwater from new development does not increase the phosphorus load to the lake. Because residential and commercial development cause such a great increase in phosphorus export, and because of the difficult nature of stormwater management, the goal selected for this section of the plan is to maintain current levels of phosphorus export; it was felt that stormwater loads could not be reduced without severely limiting development in the Basin. Management actions recommended for stormwater are listed in Table 24.

Roads and driveways were identified as a significant source of sediment and phosphorus which can and should be reduced. Unlike stormwater runoff from developed properties, there seem to be many options for reducing the impact of roads on lake water quality. Recommendations include various alternatives for improving construction of new roads, for controlling erosion and runoff, for obliterating or upgrading substandard roads, and for increasing awareness of road related water quality problems. As with the stormwater section of the plan, it is recommended that new roads be managed in a manner which will prevent the increases in phosphorus export to the lake. In addition, it is recommended that sediment and phosphorus export from existing roads be substantially reduced. Management actions recommended for roads are listed in Table 25.

Wastewater from sewage and septic systems was identified as another phosphorus source which can and should be reduced. For existing systems, the focus of this section of the plan is on reducing phosphorus loads in the most cost effective manner possible. For new systems, the focus is on installing systems with the least effect on water quality. To expedite the upgrade of substandard systems, it is recommended that developers be given the option of mitigating increased phosphorus loads which they cannot manage on site, by contributing funds to be used for systems

Table 24. Management actions recommended by development technical advisory group for stormwater.

Stormwater Management Actions **Goal: Maintain current phosphorus export in most cost effective manner.**	**Priority**	**Lead**	**Estimated Cost**	**Funding Sources**
Existing Stormwater Runoff Action 1: Provide information and technical assistance to businesses, recreationists, cities, agencies, property owners and the general public. a) Develop "Master Gardener's" type program . b) Develop a homeowners kit with info about landscaping and other methods of reducing and treating stormwater. c) Provide staff to conduct stormwater audits for businesses and property owners. d) Promote, in conjunction with the University of Idaho Cooperative Extension, the use of "lake friendly" products such as lawn fertilizer which does not contain phosphorus, and grass species which require less fertilizer. e) Inform the public on the effects of their actions, such as burning on the lakeshore and in road side ditches, boat washing, etc.	1	KC, SC, BC, DEQ	variable	fees, EPA §319, storm water utility, State of Idaho, Counties
Stormwater Runoff From New Development Action 2: Provide contractors, utility companies and the public with information on stormwater management. a) Encourage companies such as Washington Water Power to incorporate erosion control into the siting, installation, and maintenance of utilities. b) Provide information on the effects of burning construction debris on the lake shore and weeds in ditches along the road side. c) Require permit applicants to pass a test on stormwater management concepts.	1	KC, SC, BC, DEQ	variable	EPA §319 program, storm water utility, State of Idaho, Counties

Action 3: Expand existing stormwater treatment and erosion control requirements in the portions of Kootenai County which are in the Cd'A Lake Basin, to better prevent phosphorus and sediment loading from grading and development activities.			See notes	EPA §319 and §104.B3, storm water utility, fees, State of Idaho, Counties
a) Establish a stormwater ordinance requiring that development projects include a combination of stormwater treatment and pollution trading which will result in no net increase in phosphorus loading to Lake Coeur d'Alene. Expand Kootenai Counties BMP handbook to include other treatment options, in addition to swales.	1-2	KC, Cities in KC, DEQ,CT		
b) Identify phosphorus sources which might be reduced to offset increased phosphorus export from new development.	1	DEQ,PHD, USFS,KC,high-way districts		
c) Establish an ordinance requiring that erosion from development related grading projects be controlled.	1	KC,Cities in KC,CT		
d) Improve enforcement of existing erosion control requirements, including maintenance requirements. Hire staff to enforce stormwater/erosion/grading ordinances.	1	KC		
e) Establish performance standards which will minimize the quantity of sediment leaving property boundaries. (For example, prohibit increases in sediment export, or if sediment export is allowed, limit it to identified numeric standards; require stabilization within 7-14 days of soil disturbance).	2	KC,Cities in KC,DEQ, PHD,CT		
f) Adopt a Health District regulation requiring erosion control during the installation of subsurface sewage disposal systems.	3	PHD		
g) Explore funding options for stormwater and erosion control programs, including a stormwater utility.	1	KC,DEQ, PHD		
Action 4: Implement stormwater and erosion control programs throughout the remainder of the Cd'A Basin which are at least as stringent as that in place in Kootenai County in 1994.	1	SC,BC,CT, Cities in 3 Counties	variable	EPA§319,fees, utility, State of Idaho, counties
Action 5: Identify areas with a high erosion risk on plat maps of new subdivisions to inform prospective buyers/builders of the true cost involved in site development.	1-2	KC,SC,BC		developers

Action 6: Review the need to increase minimum lot sizes, increase surface water setbacks, and preserve native vegetation buffers. If necessary, develop ordinances designed to minimize sediment and phosphorous export, maintain stable lakeshores and streambanks, and ensure there will be no net increase in phosphorous exported from new development. Any new ordinances should be based on the performance standard of "no net increase" in phosphorous. New standards should apply to new, existing and platted lots along the lakeshore and its tributaries. Any variances granted should be contingent upon the project achieving no net increase in sediment and phosphorous export from development sites.	2-3	KC,BC,SC, CT, Cities in CdA Basin, DEQ		
Action 7: Prohibit burning of construction debris on lakeshores and adjacent to streams and drainageways.		KC, SC, BC, local Fire Districts		

Notes:

Action 1a. - The University of Idaho Cooperative Extension System has a Water Watch manual which may be adapted for this purpose. The UI has conducted Master Water Watch programs in the past and is willing to do so again if funding is available and other agencies participate in planning and recruiting participants.

Action 2a. - Erosion control techniques for installation of utilities might include reseeding of disturbed areas, locating utilities away from streams and drainages, and timing projects to avoid rainy seasons.

Action 3a. - This would essentially be a pollution trading system, designed to offset new phosphorus loads by reducing existing loads. Mitigation actions might include: providing funds for upgrading the Page sewage treatment plant (to increase its phosphorus removal capabilities); replacing substandard septic systems; removing unneeded dirt roads; or surfacing poorly constructed dirt roads which are eroding into Lake Cd'A or its tributaries.

Existing BMP handbooks emphasize the use of grassed infiltration areas or "swales" for treating stormwater. While swales are an excellent stormwater treatment method on the Rathdrum Aquifer, they are often unsuitable in lake watersheds with steeper slopes, less permeable soils, and high water tables. Other stormwater treatment methods should be emphasized in these areas.

The cost of implementing these actions will vary depending on the number and site characteristics of new developments, and on the desired effectiveness of the program; costs probably range from $50,000 - $120,000 per year.

Action 3g. - If a stormwater utility were formed it would be important to clearly define how the monies would be used (e.g. inspection and maintenance of stormwater systems).

Action 5 - The purpose of this action would be to ensure that prospective buyers are aware that building on erosion prone sites may be difficult or impossible, and very costly.

Action 6 - The Basin Development TAG agreed that the need for increased setbacks and native vegetation buffers should be examined. They agreed that setbacks and buffers should be adequate to minimize sediment and phosphorus entering the lake, and to maintain a stable lakeshore and streambanks. Any new requirements should be based on water quality performance standards (such as a certain level of treatment, or a certain allowable quantity of phosphorus discharge), allowing setbacks to vary based on slope, soil type, vegetative cover etc. Also it was suggested that any buffer requirements be waived in cases where there is no vegetation (e.g. a rock slope or bluff). Any variances granted should be contingent upon the project achieving no net increase in phosphorous and sediment export from development sites. The TAG could not agree on a width to recommend for buffer strips, if they are needed; suggested minimums ranged from 25 feet to 75 feet plus 4 feet for each % of slope.

Table 25. Management actions recommended by development technical advisory group for roads.

Road Management Actions **Goal: Substantially reduce sediment and phosphorus export from use and maintenance of existing roads; manage new roads so there is no net increase in phosphorus export.**	Priority	Lead	Estimated Cost	Funding Sources
Action 1: Identify owners of problem roads and driveways (USFS, state, County, Highway District, City and private) and encourage them to either obliterate or upgrade the roads in affordable increments. Use road improvements in pollution trading to offset increased phosphorus loads from new development. Encourage the use of the most cost effective, simple, expedient alternatives.	2	KC, USFS, IDL,BC,SC, highway dists., DEQ	Obliteration: ≈$105-$635/lb. P Reconstruction: ≈$2,800-$4,900/lb. P plus periodic maintenance and oversight of maintenance	EPA §319, fees, SW utility, developers, State, counties
Action 2: Develop regulations establishing minimum construction standards for private, residential roads and driveways, and require that existing roads being converted to residential use be upgraded to meet these standards, recognizing practical site limitations (e.g. permit variances for existing roads if it will decrease or not significantly increase sediment export to the lake or its tributaries). Provide land owners who are harvesting timber, with information on residential road construction standards through the Idaho Dept. of Lands.	1	KC,BC,SC, CT,IDL,ITD, DEQ, highway dists.		fees, developers, counties
Action 3: Incorporate water quality protection strategies into existing road standards, policies, procedures and decisions. Evaluate and, if necessary, revise or eliminate excessive requirements which impair water quality (e.g. wide roads and right of ways, maximum 6% grade requiring longer roads with more cuts and fills).	1	ITD,KC, BC,SC, Cities in Basin, CT, highway dists, DEQ		May be possible with existing staff
Action 4: Prevent sediment from entering road ditches from adjacent properties by adopting and enforcing erosion control and grading ordinances for development activities.	2	KC,BC,SC, Cities in Basin,CT,ITD highway dists.		See stormwater section
Action 5: Support adoption of ordinances, funding mechanisms, and programs which reduce road impacts to water quality.	2	General Public	N/A	N/A
Action 6: Request that the state, cities, counties and highway districts identify and prioritize road related water quality improvement needs, that they develop long range plans for correcting existing problems, and that they complete at least one high priority project each year.	1	highway dists, SC,BC,ITD, Cities in Basin		EPA §319, State of Idaho, counties

Action 7: Provide state, county, city and highway district personnel, businesses, and the public with technical assistance, including a) assistance in identifying situations and site specific problems affecting water quality, and b)information on maintenance and construction BMPs which can be used to reduce road impacts to water quality. Request that ITD personnel act as mentors to county and highway district staff, and that they assist with training of county road crews by inviting them to training seminars, and by providing them with printed material and video tapes of ITD seminars.	1	ITD,DEQ,KC, highway dists.		EPA §319, State of Idaho, counties
Action 8: Use LIDs (local improvement districts) to fund road improvements in populated areas.	2	KC,SC,BC, cities in Basin		private
Action 9: Encourage road jurisdictions to conserve financial resources by consolidating and/or sharing equipment, staff and functions (e.g. share wash pads, hire a grant writer for road improvement grants, consider having highway districts take over some functions of city road departments, if mutually agreed upon).	3	USFS,ITD, highway dists. BC,SC, Cities in Basin,PAC, IDL		May be possible with existing staff
Action 10: Secure grants and other funding sources for road related water quality improvement projects. Develop local, innovative funding of road programs which improve water quality, and which do not rely on property taxes.	1	PAC, highway dists., SC,KC, BC,ITD,CT, Cities in Basin		EPA §319, vehicle license fees
Action 11: Increase the general public's awareness of BMPs which should be used to control erosion and manage stormwater runoff, so they will recognize problems when they see them. Emphasize maintenance of private roads and driveways.	1	CLCC, ITD, KC,SC,BC, DEQ	variable	EPA §319, State of Idaho, counties
Action 12: Provide ITD and other road jurisdictions with vigorous, direct, constructive input about problem sites (e.g. bare slopes, erosion problems). Request that road jurisdictions use vegetative buffers between disturbed areas and streams/ drainages leading to streams.	1	General Public	N/A	N/A
Action 13: Strongly encourage ITD to complete the revegetation of the Mica grade and I-90 east of Cd'A (above Wolf Lodge Bay).	1	ITD		State of Idaho
Action 14: Request that volunteers responsible for litter collection on state highways also identify problem areas for ITD. Encourage, train and assist these groups to plant trees and other vegetation on cuts and fills.	3	ITD		State of Idaho
Action 15: Encourage the public to review proposed construction projects.	2	ITD,General Public	N/A	N/A

Action 16: Evaluate the level of treatment and stormwater retention needed for roads and highways in the Basin; expand regulations and policies as needed to prevent contaminants from reaching the water.	1	DEQ,CT and all road jurisdictions in the Basin		EPA §319, State of Idaho
Action 17: Request that road jurisdictions (ITD, highway districts, counties) control erosion during maintenance activities.	1	all road jurisdictions in the Basin		State of Idaho, counties

Notes:

Action 3 - The new Kootenai County road standards are in conflict with the stormwater ordinance and the related provision in the subdivision ordinance. It may be beneficial to water quality to permit private and small subdivision roads to serve the residential needs of a rural neighborhood without requiring large cutbacks and switchbacks which remove an excessive amount of vegetation. Variances should allow narrower roads with greater slope and more vegetative cover if it will reduce the quantity of contaminants flowing into the water, without compromising safety.

Action 6 - Road jurisdictions will need technical assistance to identify erosion and stormwater problems, and to develop mitigation plans.

Action 9 - The highway districts in Kootenai County already share some equipment and assist the cities on a case by case basis. Any consolidation of district services would have to be mutually acceptable to all involved agencies.

Action 10 - The Lake Cd'A Property Owners Association may wish to participate in raising grant match monies for specific projects which will enhance lake water quality.

Action 12 - These buffers could be temporary, used only during construction, which might eliminate the need to purchase easements.

Action 17 - Erosion control actions which might be appropriate during maintenance activities include seeding ditches following cleaning and using loose straw and silt fence on soils disturbed during replacement of culverts.

upgrades. Management actions recommended for wastewater are listed in Table 26.

A listing of recommendations that address topics such as implementation, funding, water quality standards, and miscellaneous management actions are in Table 27.

DEVELOPMENT-RECREATION SUBGROUP

Education and enforcement were identified as the highest priorities of the recreation subgroup. Several of the recommendations stemmed from the need to have better education programs, materials, maps and public outreach. Lack of adequate enforcement of existing ordinances and "rules of the road" were identified as key areas, as well.

For the most part, all the recommendations showed a greater need for either education and/or enforcement. For example, the majority of the public is not aware of erosion problems caused by excessive boat speeds in no wake zones or the effect on water quality from gray and black water disposal. From an enforcement standpoint, the Marine Sheriff's Department does not have the resources to enforce boater regulations when speed and no wake zones are ignored.

The subgroup unanimously agreed public education materials should address erosion caused by excessive boat speed, proper disposal of gray and black water and pump-out station locations. Maps are needed to identify speed zones, no wake zones as well as pump-out locations. Also there is a significant need to explain and encourage erosion control measure and decreased phosphorous and nutrient loading. Furthermore, the group stressed the importance of buffer zones for existing homes and the need to develop buffer zones for new homes.

In addition, the subgroup members strongly supported additional funding for the Marine Sheriff's Department in order to adequately enforce rules, regulations and ordinances (particularly Kootenai County's Ordinance No. 140A, addressing boat wakes), "rules of the road," boat speeds, and proper disposal practices. The subgroup recognized a significant need to increase the number of pump-out stations and promote waterborne outhouses on the lake. The management actions recommended by the subgroup are listed in Table 28.

SOUTHERN LAKE

The southern lake TAG primarily focused on slow reductions of nutrient loads via management of the aquatic macrophytes that occupy a significant portion of the shallow areas of the southern lake management zones. The TAG considered the following six alternatives for macrophyte management:

1) Lake bottom dredging-this alternative was dismissed because it is publicly unpopular, is very expensive, and has substantial impacts on the surrounding environment;

2) Herbicides-this alternative was dismissed because of toxicity concerns, impacts on biota, cost, and the fact that the U.S. Environmental Protection Agency is not funding lake restoration projects that include the use of herbicides;

3) Macrophyte mowing-this alternative was dismissed because it leaves the mowed vegetation in place and, thereby, adds nutrients

Table 26. Management actions recommended by development technical advisory group for wastewater.

Wastewater Management Actions	Priority	Lead	Estimated Cost	Funding Sources
Goal: Eliminate and/or reduce discharge of nutrients in wastewater. Prevent impacts to beneficial uses as defined in the Idaho Water Quality Standards (beneficial uses include swimming, domestic drinking water etc.).				
Action 1: Request that DEQ, EPA, and a citizen committee use the Total Maximum Daily Load process to evaluate impacts, conduct a financial evaluation of alternatives, and if needed, select methods of reducing phosphorous loads from wastewater treatment plants, beginning with the South Fork Sewer District's Page facility. Consider Basin wide funding alternatives.	1	DEQ,EPA CT	See Notes	Federal grants, State of Idaho, fees
Action 2: a) Identify old, substandard sewage disposal systems located along the tributaries and lakeshore in the Cd'A Basin. Develop a data base which can be used to locate and prioritize systems needing attention; b) Prioritize systems for upgrade and/or replacement based on their probable nutrient contribution to the lake.	(a) 1 (b) 2	PHD, DEQ, CT		EPA§ 319, State of Idaho, counties
Action 3: Encourage replacement of substandard sewage disposal systems by: a) Allowing nutrient loads for new development to be offset with upgrades of off site systems through a pollution trading system. b) Developing cost share and other incentives.	2	KC, DEQ	≈$4,400-$6,100 per pound P removed	private, developers, State of Idaho, EPA §319
Action 4: Improve maintenance of private sewage systems throughout the Cd'A Basin. Develop an operation, permitting or monitoring system and periodically inspect systems to ensure they are being maintained and are functioning properly. Vary inspection frequency according to need or use. Periodically mail maintenance reminders to homeowners with private systems.	1	PHD		fees, private, counties
Action 5: Use septic maintenance companies to help educate and communicate with homeowners about substandard sewage systems.	3	PHD		may be possible with existing staff
Action 6: Evaluate and if appropriate, modify private, Health District and state inspections of new sewage systems to ensure that systems are properly installed, and that inspection programs are as efficient as possible.	2	PHD, DEQ		may be possible with existing staff
Action 7: During plan reviews of both new and replacement sewage systems, consider clustering of the systems if it will have less impact on water quality than small, individual systems.	1 ongoing	DEQ, KC		may be possible with existing staff

Action 8: Study the effect of nitrogen on water quality, particularly in near shore areas. Where nitrogen is effecting water quality, identify and/or develop and install sewage systems which are more effective at removing nitrogen from effluent.	2	USGS, DEQ		EPA grants, State of Idaho
Action 9: Develop a method of pollution trading and/or credits so that increased phosphorus loads from new development can be offset by upgrading sewage treatment plants (i.e. new developments could have the option of mitigating their impact by contributing to a fund for needed upgrades).	2	DEQ,EPA		EPA grants, State of Idaho
Action 10: Ban phosphorus from commercial and residential laundry detergent and other cleaning products (e.g. dish washing detergent) throughout the Cd'A Basin.	1	KC,BC, SC, All Cities	minimal	existing staff

Notes:

Action 1 - It was determined that evaluation and selection of specific phosphorus reducing actions for the South Fork Sewer District's Page facility and other Waste Water Treatment Plants were beyond the scope of the planning committee. They recommend that a special committee be developed with representatives of DEQ, the sewer districts and interested citizens. It was also recommended that an economist, be consulted during the evaluation process.

As part of this wastewater review process, the effect of groundwater and stormwater infiltration on sewage lines should be explored. It appears that flows to both the Page and Plummer sewage treatment plants are higher then they need to be due to infiltration.

Providing alum treatment at the Page Plant will cost approximately \$17-\$34 per pound phosphorus removed to construct treatment facilities, plus approximately \$17 per year per pound phosphorus to purchase alum. The cost of personnel, a billing system (if an additional one is needed), and periodic maintenance costs are not known.

Action 2 - The tax assessors may be able to help locate new systems, as this is something they look for when establishing property values.

Action 4 - This might be accomplished by contracting with septic system pumpers for operational inspections. The pumpers could be trained and certified by the Health District, and could provide the Health District with an evaluation report on each system they inspect.

Action 6 - As part of this evaluation consider transferring review and inspection authority for all engineered systems to DEQ.

Table 27. Management actions recommended by development technical advisory group for miscellaneous topics.

Implementation/ Funding/ Water Quality Stds./ Miscellaneous Management Actions	Priority	Lead	Estimated Cost	Funding Sources
Action 1: Require local, state and federal agencies to coordinate data gathering efforts.	1	DEQ		existing staff
Action 2: Establish a citizens committee to assist in developing and implementing a public information and education program for the Cd'A Basin, and in lobbying for plan implementation.	1	CBRP,CAC		State of Idaho
Action 3: Encourage the development of and promote "lake friendly" products (e.g. boat cleaner, pesticides/ herbicides, phosphorus free lawn fertilizer).	1	CLCC		State of Idaho
Action 4: Incorporate water quality protection strategies into county Comp Plans, and Zoning, Grading and Subdivision Ordinances.				
Action 5: Consider expanding the Cumulative Effects program to address all watershed activities; manage cumulative effects Basin wide.	2	IDL, CBRP		
Action 6: Establish funding for plan implementation, with an emphasis on fees for service, user fees, and Federal funding. Avoid the use of state and County monies (which are based on property and income taxes). **Implement this plan in the most cost effective manner, using alternatives which remove the most phosphorus per dollar expended.**				
Action 7: Fund a coordinator(s) to oversee implementation of this plan.		DEQ,EPA, CDA Tribe, CLCC,KC, BC,SC		
Action 8: Form a private foundation to seek implementation funding.				
Action 9: Contract with a stormwater hydrologist for technical support for jurisdictions developing and enforcing stormwater management ordinances for the Basin.		KC, BC, DEQ		

Action 10: Revise state Water Quality Standards for the Cd'A Basin, to make them less ambiguous, more enforceable, and more effective at preventing sediment, phosphorus and other contaminants from entering Lake Cd'A and its tributaries. a) Develop erosion control, stormwater management, road maintenance and vegetative buffer (if needed) requirements and BMP's for the Cd'A Basin and reference them in the Water Quality Standards. b) Develop broader, more proactive standards which will prevent the loss of beneficial uses and ensure that those uses are maintained for future generations. Use common terms and explanations to clarify the intent of ambiguous or technical sections of the Standards. c) Expand sediment criteria for domestic water supplies, to include Lake Cd'A and any tributaries with 15 or more homes using the water for domestic purposes (i.e. drinking water). d) Evaluate and if necessary make improvements to the enforcement provisions of the Standards.	1	DEQ,CT		State of Idaho

Notes:

Action 1 - The purpose of this action is to minimize duplication and assure that publicly funded monitoring projects produce compatible data which can be used by all agencies, for different projects. For example, if two agencies are conducting monitoring in the same location, they may be able reduce transportation and salary expenses by having one individual collect samples for both agencies.

Action 4 - Present Kootenai County with a copy of this plan as soon as possible so that they may incorporate it into their new zoning ordinance. Also present Shoshone County, Benewah County, the CDA Tribe and others with a copy so they may start incorporating this plan into their regulations and ordinances.

Action 6 and 7 - Implementation oversight should be provided by a Board consisting, at a minimum, of representatives of DEQ, EPA, the Coeur d'Alene Tribe, and Kootenai, Benewah and Shoshone Counties. A mechanism should also be developed to keep citizens involved in plan implementation.

Action 10 -

a. Include all stakeholders in the development of these requirements and BMP's.
b. For example, develop sediment standards which apply to all tributaries, and which are designed to minimize the quantity of sediment reaching the lake (and thus prevent unacceptable changes to lake water quality and beneficial uses). Sediment criteria for fish and drinking water systems should be retained, but should be supplemented by a broader, basin wide standard.

Table 28a. Management actions recommended by recreation subgroup of the development technical advisory group.

Public Education **Goal: Provide for enjoyable, recreational experiences on the lake while promoting water quality protection and safety.**	**Priority**	**Lead**	**Estimated Cost**	**Funding Sources**
Action 1: Promote and support implementation of Ordinance No. 140-A, which regulates boat wakes.	1	KC		
Action 2: Develop education materials regarding setback and containment of campfires on beaches, etc.	1	CLCC		

Table 28b. **Gray and Black Water Disposal Options**	**Priority**	**Lead**	**Estimated Cost**	**Funding Sources**
Action 1: Develop pamphlet describing proper disposal at pump-out stations. Encourage operator instruction.	1	CLCC		
Action 2: Develop a current comprehensive map of all the pump-out station locations.	1	CLCC, PHD		
Action 3: Encourage increased number of pump-out stations at marina locations. (It was suggested that marinas may wish to charge a pump-out fee or a discount with gasoline purchase, for example.)	1	BC,KC, PHD		
Action 4: Promote installation of sealed disposal systems for grey water.	1	PHD		
Action 5: Promote the use and funding for waterborne outhouses on the lake.	2	IDPR		
Action 6: Require holding tanks for gray water disposal for new manufactured boats.		KC, BC, USCG		

Table 28c. **Industrial Uses on the Lake**	**Priority**	**Lead**	**Estimated Cost**	**Funding Sources**
Action 1: Examine impact of industrial uses on the lake. Such as log transport, evaluate impacts of log transport and storage. Examine the logging operations (storage on the lake), as these effect nutrient levels.	2	IDL,DEQ		
Action 2: Develop support for public land managers of recreation sites contaminated with metals (IDFG, IDPR, USFS, BLM) to develop barriers between the public and metals and to provide sources of potable water.	1	IDFG,BLM USFS, IDPR		

to the lakebed sediments;

4) Manual, biological, and bottom barriers-these alternatives were dismissed because the large area to be treated was beyond their scope of application;

5) Rotovation-this alternative was closely considered but was eventually dismissed because it dramatically disturbs the lakebed sediments, releases nutrients into the water column, and its production of suspended sediment adversely affects spawning and migration of fish.

6) Mechanical harvesting-this alternative was chosen because it removes harvested plants and their associated nutrients from the lake, has a lesser impact on fish and other organisms, and should promote the leaching of nutrients from the sediment to establish some nutrient equilibrium in the future. The southern lake action items appear in table 29.

RIVERS

After familiarizing itself with the key issues pertaining to the rivers, river TAG participants identified bank erosion, permitting, and weed growth as the problems to be addressed. The group recognized that bank stabilization is necessary to curtail erosion and accompanying nutrient yield from both rivers. An inventory is necessary to develop priorities (action item 1). The technically simple approach of limiting boat size and speed was discussed. The group felt political support for the approach could not be developed. An educational program covering damage by boat wakes was requested (action item 2). Bank stabilization will require considerable funding. Action item 3 was designed to raise funds from users. Bank stabilization over the considerable mileage of the two rivers will be required. Development of a standard inexpensive method, to accomplish this is required (action item 4). The St. Joe River has less drastic erosion problems located primarily on undeveloped banks. Action item 5 recognized revetments use as a promising approach, the effectiveness of which should be demonstrated. Action item 6 directs bank stabilization as funds are available, recognizing that priorities must be set in completion of the work. The active participation in stabilization efforts of state and federal land managers who control a large part of the river frontage is sought in action item 7. In its numerous discussions of bank erosion of the Coeur d'Alene River, the work group was unable to assess the value of bank stabilization in reducing metals loading to the river and the lake. Although bank erosion is one mechanism, others have been identified and their relative contributions to the metals load is not understood. As a result, action item 8 requests a study of the amount of metals loading from the various loading mechanisms with consideration of the effect of different management approaches.

Problems with obtaining permits has prevented voluntarily bank stabilization work. A standard mechanism for permitting small stabilization projects exists. A pamphlet should be produced to educate the public about the permits available and suggests acceptable standardized methods. Although weed growth along the river is a local problem, the group found no economic means to address it. The management actions recommended by the rivers TAG are listed in Table 30.

Table 29. Management actions recommended by southern lake technical advisory group.

Southern Lake Management Actions **Goal: Reduce nutrient loading to the Southern Lake in the Most effective and cost efficient manner.**	Priority	Lead	Estimated Cost	Funding Sources
Reduction of Nutrient Load in Lake Bed Sediments Action 1: Slowly reduce nutrient load by systematically harvesting macrophytes. Investigate and implement mechanical harvest for co-generation, fertilization, compost or methanol production.	1	Tribe, DEQ, I&FG, IP&R, I.D.L., CLCC	'	Tribe, Federal Program, Develop Corp, Panhandle area Council Dept. of Commerce, Parks & Rec. User fee of $3/boat
Reduce sediment/nutrients loading from river/lake bank erosion. Action 2: Control bank & bottoms sedimentation by expanding and enforcing no-wake zones, controlling log boom scower and managing the size and speed of boats.		Counties IP.&R., Corp. of Eng., I.D.L.		Coast Guard Grant, County Fees

The Southern Lake Technical Advisory Group recommends to the Lake Planning Workgroup that the only action item that should be considered is the development of an "Integrated Aquatic Plant Management Plan". The emphasis of the "Plan" should focus on removal of aquatic plants from the Southern Lake by means of Mechanical Harvesting. During the scoping process many alternatives were considered and dismissed for various reasons but primarily because of environmental impacts. Methods of aquatic plant management that were considered including moving, biological control, bottom barriers, rotovating, dredging, herbicides, and mechanical harvesting. Because of the size and complexity of the Southern Lake, a combination of some of the above mentioned methods most likely will need to be addressed in the "Plan".